Iron requirements in women and children

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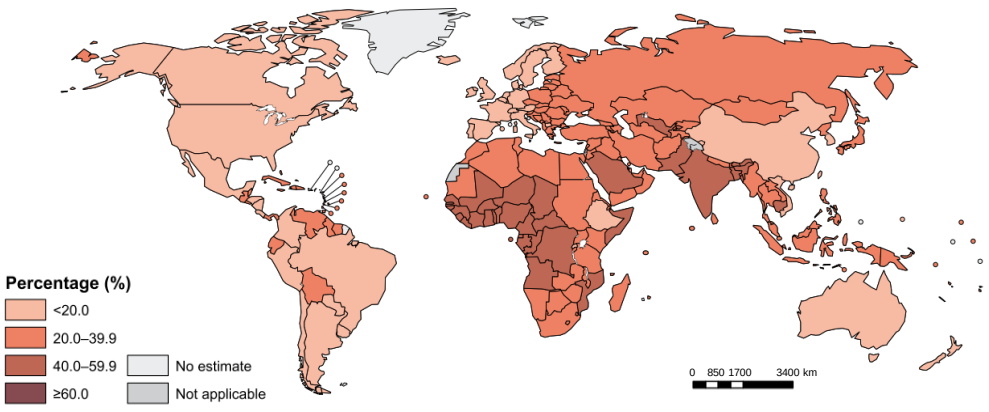
Funding: ETH Zürich

Reliable data on iron requirements as well as the proportions of iron absorbed and lost are crucial for design and implementation of iron intervention programs. Our findings are invaluable for further programs to improve iron nutrition.

Global anemia prevalence in women of reproductive age, WHO 2011



Iron deficiency is the most common nutritional disorder worldwide. Reliable data on iron requirements are crucial for reaching the goal of a 50%-reduction in anemia prevalence among women of reproductive age implemented in the Zero Hunger Goal of the UN Sustainable Development Goals.

After uniform labelling of total body iron with an isotopic tracer, absorption of iron is proportional to the rate of decrease in the concentration of this tracer in the circulation while loss of iron is proportional to the rate of decrease in the amount of the tracer.

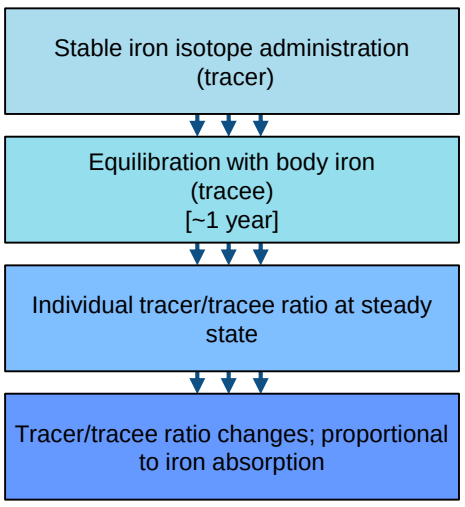


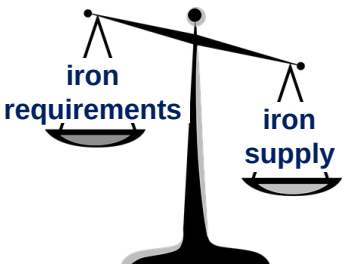
Fig. 1. Systematic overview of the dilution of labelled body iron.

In adults iron loss then represents iron requirements, while the amount of iron required for growth ia added to basal iron losses to determine iron requirements in children.

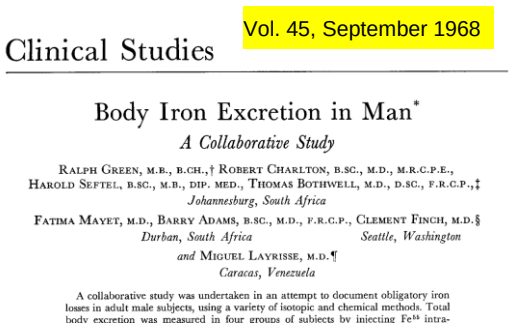
	WHO/FAO estimates: factorial modeling	direct isotopic measurement	
		Normal	3-months iron supplementation*
Median iron absorption, mg/d			
toddlers 1- 3 years	0.46	0.31 (0.23;0.37)[a]	0.76 (0.62;1.00)[b]
children 4 – 6 years	0.5	0.57 (0.52;0.70)	-
children 7 – 10 years	0.71		
females 11 – 14 years	1.68		
females 15 – 17 years	1.62		
females 18+ years	1.46	0.58 (0.11;1.36)†[a] 1.60 (1.15;1.77)‡[a]	3.90 (1.45;4.96)†[b] 3.66 (3.11;4.44)‡[b]
Median basal iron losses, mg/d			
toddlers 1- 3 years	0.19	0.26 (0.12;0.37)[a]	0.54 (0.40;0.74)[b]
children 4 – 6 years	0.27	0.37 (0.23;0.43)	-
children 7 – 10 years	0.39		
females 11 – 14 years	1.13		
females 15 – 17 years	1.27		
females 18+ years	1.35	2.19 (0.13;2.99)† 0.94 (0.11;1.48)‡[a]	1.89 (-0.82;2.90)† 2.38 (1.18;3.29)‡[b]
Iron required for growth, mg/d			
toddlers 1- 3 years	0.17	0.06 (-0.05;0.17)[a]	0.21 (0.08;0.37)[b]
children 4 – 6 years	0.23	0.26 (0.18;0.34)	-
children 7 – 10 years	0.32		
females 11 – 14 years	0.55		
females 15 – 17 years	0.35		
females 18+ years	-	-1.05(-2.11;0.22)†[a] 0.39 (-0.36;1.49)‡	2.75 (1.87;4.07)†[b] 1.35 (0.91;1.83)‡

* 12 mg iron as ferrous sulphate in MixMe micronutrient powders daily in Gambian toddlers and 50 mg iron as ferrous sulphate in Eisensulfat Lomapharm® iron tablets daily in Benin and Switzerland.

† Women of reproductive age in Benin. ‡ women of reproductive age in Switzerland.



Nutritional ID occurs when physiological iron requirements cannot be covered by iron absorption. However, as physiological iron requirements are difficult to predict, dietary iron intake recommendations by WHO are based on one early publication from the 1960s.


Clinical Studies

Vol. 45, September 1968

Body Iron Excretion in Man*

A Collaborative Study

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A collaborative study was undertaken in an attempt to document obligatory iron losses in adult male subjects, using a variety of isotopic and chemical methods. Total body excretion was measured in four groups of subjects by injecting Fe[59] intra-

Iron requirements set by WHO/FAO through indirect factorial modeling appear to be in agreement with directly measured iron absorption, iron losses and amounts of iron required for growth in healthy Malawian children and Swiss‡ women. Still, Beninese† women and African toddlers can absorb enough iron to cover basal iron losses and growth requirements only with the consumption of iron supplements.

Our data nicely and directly confirm iron recommendations by WHO.

Furthermore, our data strongly emphasizes on the role of iron bioavailability in the diet for covering iron requirements (iron intake in mg/d was higher in Benin compared to Switzerland, $p<0.001$) and opens questions about the pathophysiology of iron supplementation.